DOCUMENT RESUME

ED 107 006 95 EC 072 448

| | |
|---|---|
| AUTHOR | Frus, Patricia H.; And Others |
| TITLE | Summative Evaluation of the Measurement of Weight Unit of the Money, Measurement and Time Program. Research Report No. 72. |
| INSTITUTION | Minnesota Univ., Minneapolis. Research, Development, and Demonstration Center in Education of Handicapped Children. |
| SPONS AGENCY | Bureau of Education for the Handicapped (DHEW/OE), Washington, D.C. |
| REPORT NO | 332189 |
| PUB DATE | Oct 74 |
| GRANT | OEG-09-332189-4533(032) |
| NOTE | 73p.; For related documents, see EC 072 446-449 and EC 072 452 |
| EDRS PRICE | MF-$0.76 HC-$3.32 PLUS POSTAGE |
| DESCRIPTORS | Concept Formation; *Educable Mentally Handicapped; *Elementary Education; *Evaluation; Exceptional Child Research; *Instructional Materials; Mentally Handicapped; Vocabulary; *Weight |
| IDENTIFIERS | Money Measurement and Time Program |

ABSTRACT

Field testing of the Weight Unit of the Money, Measurement and Time Program was conducted with 23 elementary school classes of educable mentally handicapped (EMH) children. The 227 Ss were assigned to the experimental group, the Hawthorne group, or the control group. Two criterion referenced tests were administered to determine Ss' functional understanding of weight, their weighing skills, and related vocabulary skills. Testing demonstrated that the unit increased Ss' knowledge of weight skills and vocabulary. Analyses of community location effects indicated that the unit was quite effective in rural and suburban communities, as well as in urban areas. All teachers who returned evaluation forms (57 percent) experssed a preference for the unit over other instructional materials. (GW)

ED107006

RESEARCH REPORT #72

Project No. 332189
Grant No. OE-09-332189-4533 (032)

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

# SUMMATIVE EVALUATION OF THE MEASUREMENT OF WEIGHT UNIT OF THE MONEY, MEASUREMENT AND TIME PROGRAM[1]

Patricia H. Krus, Martha L. Thurlow, James E. Turnure, Arthur M. Taylor[2]
University of Minnesota

Research, Development and Demonstration
Center in Education of Handicapped Children
University of Minnesota
Minneapolis, Minnesota

October 1974

The research reported herein was performed pursuant to a grant from the Bureau of Education for the Handicapped, U. S. Office of Education, Department of Health, Education and Welfare to the Center of Research, Development and Demonstration in Education of Handicapped Children, Department of Psychoeducational Studies, University of Minnesota. Contractors undertaking such projects under government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official position of the Bureau of Education for the Handicapped.

Department of Health, Education and Welfare
U. S. Office of Education
Bureau of Education for the Handicapped

EC 072448

RESEARCH AND DEVELOPMENT CENTER
IN EDUCATION OF HANDICAPPED CHILDREN
Department of Special Education

Pattee Hall, University of Minnesota, Minneapolis, Minnesota 55455

The University of Minnesota Research, Development and Demonstration Center in Education of Handicapped Children has been established to concentrate on intervention strategies and materials which develop and improve language and communication skills in young handicapped children.

The long term objective of the Center is to improve the language and communication abilities of handicapped children by means of identification of linguistically and potentially linguistically handicapped children, development and evaluation of intervention strategies with young handicapped children and dissemination of findings and products of benefit to young handicapped children.

# Summative Evaluation of the Measurement of Weight Unit of the Money, Measurement and Time Program[1]

Patricia H. Krus, Martha L. Thurlow, James E. Turnure, Arthur M. Taylor[2]
University of Minnesota

Educational evaluation has generally been assumed to refer to "the collection and use of information to make decisions about an educational program" (Cronbach, 1963). This process may occur either during the development of the program, or after development has been completed. Ideally, it should occur during both stages. Scriven (1967) has named these two stages of evaluation as "formative" and "summative." Formative evaluation occurs during the development of an instructional product while summative evaluation occurs when the "final" instructional product is in a field-test situation. The purpose of a formative evaluation is to identify strengths and weaknesses so the product can be revised as it is being developed. The purpose of a summative evaluation is to assess the effectiveness of the product in the classroom.

Over the past two years, the Money, Measurement and Time Program has been subjected to both formative and summative evaluations. The Program was developed for educable mentally retarded (EMR) children by the Vocabulary Development Project (a joint effort of the Research, Development and Demonstation Center at the University of Minnesota and the Special Education Department of the St. Paul Public Schools). As each unit in the Program was being developed, it underwent an extensive formative evaluation process (cf., Krus, Thurlow, Turnure, Taylor, & Howe, 1974). Revisions of all units were made on the basis

of the feedback from the formative evaluations in order to prepare them for use in a large scale field-test. The summative evaluation of the units occurred during this field-test.

The present paper is a description of the summative evaluation of the Measurement of Weight Unit, one of the five units in the Money, Measurement and Time Program. Formative evaluation of the Weight Unit took place over a period of one year, and produced a revised unit designed to teach weight concepts to EMR children (Thurlow, Krus, Howe, Taylor, & Turnure, 1974). The purpose of the summative evaluation of the Measurement of Weight Unit was to test the effectiveness of the revised unit and its useability in the classroom when interactions between Project personnel and field-test participants were minimal.

The Money, Measurement and Time Program

The Money, Measurement and Time Program (Thurlow, Taylor, & Turnure, 1973) is an instructional program designed for young educationally handicapped learners. The Program includes five units: 1) Money, 2) Measurement of Length, 3) Measurement of Weight, 4) Time with the Clock, and 5) Time with the Calendar. Systematic instruction is provided in these areas, without requiring that the children have reading or computational skills. Further information about the specific instructional units in the Program is available in the Teacher's Introduction to the Program (Thurlow, Taylor & Turnure, 1973).

The Money, Measurement and Time Program was developed from basic learning strategies research, such as research on mental imagery

and verbal elaboration. It represents one of the first attempts to translate these recently developed areas of experimental research into an instructional program for EMR children.

The general aims of the Money, Measurement and Time Program were to develop vocabulary and related skills, and furthermore, to provide general language development and the development of effective learning strategies. Several specific goals of the Program included: 1) an improved understanding of the critical vocabulary, and thereby better understanding of the general area of instruction (money, measurement, or time), 2) the development of beginning skills in the particular area of instruction, with an emphasis on use of these skills in everyday situations, 3) an increase in general language development, especially expressive communication, and 4) the use of more efficient learning and memory strategies which could apply to other areas of instruction.

Measurement of Weight Unit

The Measurement of Weight Unit, like the other units in the Program, was developed jointly by educational practitioners and educational researchers. Initially, the Unit was produced in a pilot-test form consistent with a verbal elaboration-based instructional approach found to be successful with EMR children (Taylor, Thurlow, & Turnure, 1974). The version was subjected to extensive formative evaluation and revision (Thurlow, Krus, Howe, Taylor, & Turnure, 1974). Through the development of both vocabulary and skills, the revised Measurement of Weight Unit attempts to provide EMR children

with an understanding of certain concepts related to weight and its measurement. It is this revised version that was employed in the field-test and subjected to summative evaluation.

The field-test version of the Measurement of Weight Unit included two books of instruction designed to be used sequentially. The instruction begins by introducing the comparatives of weight (e.g., heavier, lighter, etc.), and proceeds to instruction related to the basic tools and units of weight, including the actual skill of weighing.

The instructional content of the two books of the Measurement of Weight Unit was written to stress the gradual and closely structured development of both weight vocabulary and weighing skills. The two books in the Weight Unit and the instruction within them represent progressive levels of instruction, from the lowest to the most advanced. Depending upon the ability of the children, a book of instruction might take from one week to several months to complete. Children may begin instruction at various points depending on their beginning skills. Individually administered assessment instruments are provided for initial diagnostic placement and for determining final achievement.

The instructional materials in the Measurement of Weight Unit included teacher's editions (two books), cassette tapes containing definitions and stories related to important concepts, books of pictures for the children to follow as the tape was presented, and numerous worksheets and transparencies to complete the instruction. Each book of instruction is composed of lessons that contain instruction

related to one or more vocabulary words. Each lesson is associated with specific purposes and behavioral objectives. The lessons within a book are carefully ordered, with behavioral objectives in one lesson being requisite for adequate performance in later lessons. A lesson, which usually requires several periods of instruction, includes three major components: 1) pre-activities which introduce the concepts or review the meaning of necessary prerequisite concepts, 2) tape presentations which develop the meaning of vocabulary words and the relations between words, and 3) post-activities which review and reinforce the concepts and relations established in the tape presentation.

The Summative Evaluation Plan

The desired field-test plan, in which classes would be allowed to spend at least one year progressing through the instruction in the Measurement of Weight Unit, could not be implemented due to budget and time restrictions. Instead, the field-test of the Weight Unit was carried out in conjunction with the field-test of the Measurement of Length Unit. Thus, except for a few classes, instruction in the Weight Unit was started after the children had received from three to four months of instruction in the Length Unit. Instruction in the Weight Unit for all classes was presented for a period of four to six weeks. A similar plan was used to test the Money and Time with the Clock Units.

Design

A two factor design (Treatment X Community) was employed in the summative evaluation of the Measurement of Weight Unit. The major factor of interest was the instructional treatment factor. The three treatment groups in the present design were: 1) Experimental, 2) Hawthorne, and 3) Control.

The Experimental treatment group included those classes receiving the Measurement of Weight instructional program. These classes did not receive any supplemental instruction on weight concepts.

The Hawthorne treatment group consisted of classes receiving instruction in the Time with the Clock Unit from the Money, Measurement and Time Program. The Hawthorne group was included in the design as one type of control. Gains on the Weight Tests by this group would represent changes in performance one could expect from the "novelty" of a new program in the classroom, interactions with testers, "learning to learn," and several other factors. To conclude that the Measurement of Weight instruction itself contributed significantly to performance increases, one must discover that the Experimental group performed significantly better than the Hawthorne control group.

The Control treatment group consisted of classes where teachers were left on their own, either to teach or not to teach weight concepts. When these teachers chose to teach weight, they were allowed to use any materials available to them (e.g., published materials, teacher-developed materials, etc.), but they were not allowed to use the Measurement of Weight Unit from the Money, Measurement and Time Program.

The second factor in the design was that of community location (urban, rural, or suburban). The categorization of communities as urban, rural, or suburban concurred with the categorization scheme of the Minnesota Department of Education. Urban communities included three of the four major cities in Minnesota. Suburban communities were ones which immediately adjoined these cities. Rural communities included those not covered by the above classification systems. It should be noted that these "rural" communities were somewhat different from the usual conception of "rural." For instance, one rural community contained two small colleges, another contained one. Also, academic and professional people lived in some of the "rural" communities and commuted daily to work in a nearby urban community.

Subjects

The population employed for field-testing during the summative evaluation was elementary school-aged educable mentally retarded children. Of the 23 classes employed during the field-test of the Measurement of Weight Unit, seven classes (3 urban, 2 rural, 2 suburban) were chosen to be in the Experimental treatment (i.e., they received instruction in the Measurement of Weight Unit), eight classes (4 urban, 3 rural, 1 suburban) were included in the Hawthorne control treatment (i.e., they received instruction in the Time with the Clock Unit), and eight classes (3 urban, 2 rural, 3 suburban) were included in the Control treatment (i.e., they received instruction from any source other than the Measurement of Weight Unit, if the teacher chose

to give it to them). Assignment of the classes to the treatments was predetermined by the fact that children receiving the Measurement of Weight Unit were ones who had received the Measurement of Length Unit, and children in the Hawthorne group were ones who had previously received the Money Unit. Two classes were added to the Experimental treatment group at the beginning of this field test (i.e., these classes had not received the Length unit). They were chosen to be older and of a higher level of functioning since the summative evaluation of the Measurement of Length Unit revealed that the Experimental group children were of a somewhat lower level of functioning than the children in the Hawthorne group (Krus, Thurlow, Turnure & Taylor, 1974).

Overall, there were 66 children (31 urban, 15 rural, 20 suburban) in the Experimental group, 79 (38 urban, 31 rural, 10 suburban) in the Hawthorne group, and 82 (28 urban, 23 rural, 31 suburban) in the Control group. It should be noted, however, that the specific numbers of children for whom data from specific tests were available varied due to scheduling problems and absenteeism.

A summary of the children's IQs, mental ages (MAs) and chronological ages (CAs) in the three treatment groups is presented in Table 1, along with the results of a one-way factorial analysis on each measure. Again, it should be noted that the number of subjects varied with the measure due to incomplete test data. Clearly, the three groups did differ significantly on IQ level and CA. A Newman-Keuls test for differences between the IQ means indicated that the

Table 1

Comparisons Between the Three Treatment Groups on IQ, MA, and CA

| | Experimental | Hawthorne | Control | F |
|---|---|---|---|---|
| IQ | | | | |
| $\bar{X}$ | 68.3 | 70.6 | 74.2 | 7.04 |
| SD | 10.1 | 8.5 | 9.3 | ($p < .001$) |
| Range | 47-89 | 49-85 | 56-88 | |
| n | 62 | 67 | 73 | |
| MA (months) | | | | |
| $\bar{X}$ | 75.7 | 73.3 | 76.5 | 1 |
| SD | 13.8 | 13.2 | 14.8 | (ns) |
| Range | 50-114 | 44-98 | 50-118 | |
| n | 61 | 66 | 73 | |
| CA (months) | | | | |
| $\bar{X}$ | 119.8 | 101.0 | 102.1 | 5.81 |
| SD | 19.9 | 17.2 | 18.8 | ($p < .01$) |
| Range | 63-145 | 63-136 | 74-142 | |
| n | 66 | 79 | 82 | |

Control group had a significantly higher IQ than the Experimental group ($p < .01$) and that the Control group had a significantly higher IQ than the Hawthorne group ($p < .05$). The Experimental and Hawthorne groups did not differ significantly on IQ. A Newman-Keuls test on the CA means revealed that the Experimental group was significantly older than both of the other groups ($ps < .01$). No differences existed on the MA measure, the measure often viewed as most important in determining a relative level of functioning.

Table 2 presents the IQ, MA, and CA data arranged according to community location. One-way factorial analyses revealed a significant effect of community location for each measure. Newman-Keuls tests for differences indicated that children in the rural community had higher mean MAs and CAs than those in both the urban and suburban communities ($ps < .01$), and higher IQs than the children in the urban community ($p < .01$). The suburban children also had higher IQs than the urban children ($ps < .01$).

Tests

Two criterion-referenced tests were administered to the children to determine the effectiveness of the Measurement of Weight Unit. Each test was administered as a pretest, and at the same time, served to determine the placement of a class within the sequence of instruction. The same tests were administered as the posttest at the end of the year.

The Weight Skills Test was a thirteeen item test designed to determine the children's functional understanding of weight and their weighing skills. It consisted of three subtests which evaluated skills

Table 2

Comparisons Between the Three Treatment Groups on IQ, MA, and CA

| | Urban | Rural | Suburban | |
|---|---|---|---|---|
| IQ | | | | |
| $\bar{X}$ | 67.22 | 72.61 | 74.91 | F |
| SD | 9.91 | 7.88 | 9.17 | 13.06 |
| Range | 47-89 | 49-88 | 56-93 | ($p < .001$) |
| n | 77 | 69 | 57 | |
| MA (months) | | | | |
| $\bar{X}$ | 71.93 | 83.19 | 69.88 | 20.73 |
| SD | 14.68 | 12.18 | 10.80 | |
| Range | 44-114 | 62-118 | 53-102 | ($p < .001$) |
| n | 74 | 69 | 57 | |
| CA (months) | | | | |
| $\bar{X}$ | 104.54 | 112.60 | 91.52 | 22.62 |
| SD | 20.52 | 20.10 | 12.17 | |
| Range | 63-148 | 81-143 | 75-121 | ($p < .001$) |
| n | 97 | 80 | 62 | |

ranging from the comparative to actual measuring. This test was administered to all children (except, of course, those who are absent, etc.). The test-retest reliability of the Weight Skills Test was .72.

The Weight Expressive Test was a fourteen item test designed primarily to evaluate the child's ability to utilize specific vocabulary words. It consisted of three subtests which correspond to the major entry points into the instruction. Again, this test was administered to all available children. The test-retest reliability of the Weight Expressive Test was .86.

A Cognitive Abilities Test (Thorndike, Hagen, & Lorge, 1968) was also administered to the children participating in the present field-test. Since this test was employed to evaluate the child's general improvement in non-content specific areas of cognitive functioning after a full year of instruction in the Money, Measurement and Time Program, the results of this test will not be described here.

Procedure

The field-test of the Measurement of Weight Unit was conducted over a period of four to eight weeks. The goal of the field-test was to assess the Weight Unit under relatively "normal" classroom conditions, with minimal interaction between Project personnel and field-test participants.

Before instruction was started, children in each class were pretested on the Weight Skills and Expressive Tests. Then, each teacher in the Experimental treatment group was given a written

introduction to the Measurement of Weight Unit (see Appendix 1), and those teachers who had not participated in the field-test of the Measurement of Length Unit were also given a brief in-service training session to introduce them to the Money, Measurement and Time Program, and to familiarize them with the field-test plan. Interactions with the classes stopped at this point (except for "comment cards" returned to Project Directors when the teachers felt comments were necessary), until posttesting time.

After instruction ended, classes were posttested on the Weight Tests and the Cognitive Abilities Test. At this point, teachers were requested to complete a detailed questionnaire on their reactions to the Unit, and to the Program in general. Control teachers were also asked to describe any instruction related to weight that they had used during the same period.

## Results

During the summative evaluation of the Measurement of Weight Unit, the major sources of effectiveness data were the results of the pretesting and posttesting. Only a limited number of the children participating in the field-test actually received both the pretest and the posttest due to absenteeism, school schedules, etc. In order to benefit from the larger number of children in the total sample, it was decided that all pretest data and all posttest data would be analyzed although the results from the pretest would include some children not posttested, and vice-versa. These results are presented in two sections: 1) Pretest comparisons, and 2) Posttest comparisons.

The next section included in the results presents the data of just those children who were both pretested and posttested on the Weight Skills and Expressive Tests. The pretest to posttest comparisons on these data, although based on a reduced sample size, are probably the most reliable for assessing the effectiveness of the Measurement of Weight Unit.

Data related to the performance of the three treatment groups on individual items in the Weight Tests will also be presented. These data not only provide further information on the effectiveness of the Unit, but also have the potential for identifying possible areas where revision of the instruction should be recommended.

The Results section will conclude with two additional sets of results. These results deal with: 1) Community location comparisons, and 2) Feedback from teacher evaluations.

Pretest Comparisons

In order to compare the posttest results of the three treatment groups (and so assess the effectiveness of the Weight Unit), pretest scores must first be compared to show that there were no differences between the three treatment groups on the Weight Tests before instruction. Table 3 presents the means and standard deviations of the pretest scores on the two Weight Tests, and the results of a one-way analysis of variance on each set of scores.

The results of the analysis of variance indicate that there were no significant differences between the three treatment groups on either the Weight Skills pretest or the Weight Expressive pretest. Thus,

Table 3

Comparisons of the Three Treatment Groups on Weight Skills and Weight Expressive Pretests

Weight Skills Test (13 items)

| | Experimental | Hawthorne | Control | F |
|---|---|---|---|---|
| $\bar{X}$ | 6.45 | 6.34 | 6.98 | <1 |
| SD | 2.76 | 2.46 | 2.21 | (ns) |
| n | 60 | 35 | 42 | |

Weight Expressive Test (14 items)

| | Experimental | Hawthorne | Control | F |
|---|---|---|---|---|
| $\bar{X}$ | 5.33 | 5.37 | 5.98 | <1 |
| SD | 3.03 | 2.87 | 2.57 | (ns) |
| n | 60 | 35 | 42 | |

differences found between the Experimental group and the other groups in posttest comparisons may be assumed to adequately reflect differences resulting from the instruction.

Posttest Comparisons

The means and standard deviations of the posttest scores on the Weight Tests, and the results of a one-way analysis of variance, are presented in Table 4. Follow-up analysis on the significant treatment effect on the Weight Expressive Test by means of a Newman-Keuls procedure indicated that the Experimental group scored significantly higher than both of the other two groups ($ps < .01$), and that the Control group scored higher than the Hawthorne group. The higher IQ level of the Control group might be related to the unexpectedly better performance of this group at posttest time.

Pretest to Posttest Comparisons

In order to avoid some of the limitations of analyzing all pretest and all posttest data separately, a procedure which does not recognize that all children were not both pretested and posttested, the scores of just those children receiving both tests were analyzed. Table 5 presents the means and standard deviations for those children receiving both the Weight Skills pretest and the Weight Skills posttest. Table 6 presents similar data for the Weight Expressive Test. As compared to the data in Table 3 and 4, there is a significant decrease in the number of children assessed. Consequently, both the pretest and posttest means and standard deviations are also somewhat different than those presented previously.

Table 4

Comparisons of the Three Treatment Groups on Weight Skills and Weight Expressive Posttests

Weight Skills Test (13 items)

| | Experimental | Hawthorne | Control | F |
|---|---|---|---|---|
| $\bar{X}$ | 7.69 | 6.92 | 7.66 | 1.26 |
| SD | 2.66 | 2.58 | 2.19 | (ns) |
| n | 62 | 38 | 39 | |

Weight Expressive Test (14 items)

| | Experimental | Hawthorne | Control | F |
|---|---|---|---|---|
| $\bar{X}$ | 8.43 | 5.10 | 6.82 | 16.04 |
| SD | 2.80 | 3.09 | 2.50 | ($p < .001$) |
| n | 62 | 36 | 39 | |

Table 5

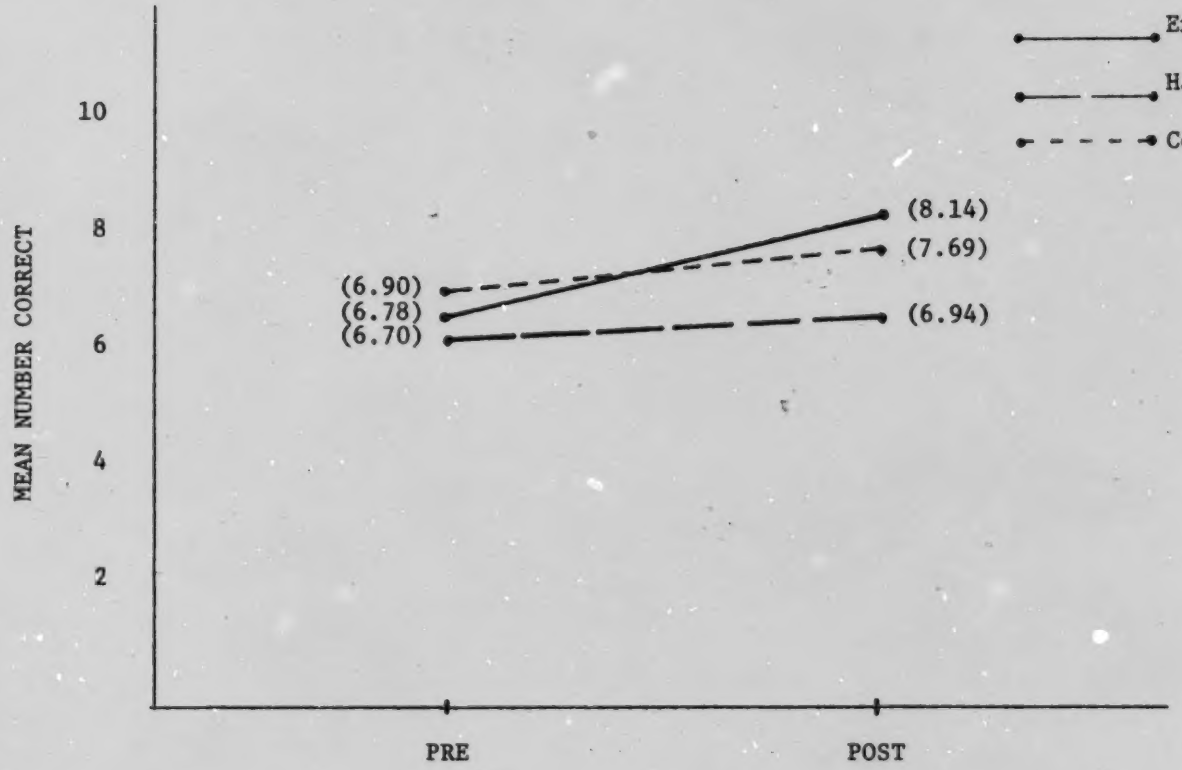
Pretest to Posttest Comparison of Subjects Receiving both Pre and Post Weight Skills Tests

| | Experimental | | Hawthorne | | Control | |
|---|---|---|---|---|---|---|
| | Pre | Post | Pre | Post | Pre | Post |
| $\bar{X}$ | 6.78 | 8.14 | 6.70 | 6.94 | 6.90 | 7.69 |
| SD | 2.67 | 2.44 | 2.19 | 2.29 | 2.24 | 2.23 |
| n | 55 | 55 | 33 | 33 | 39 | 39 |
| | $t = 4.71$ | | $t < 1$ | | $t = 2.56$ | |
| | ($p < .005$) | | (ns) | | ($p < .01$) | |

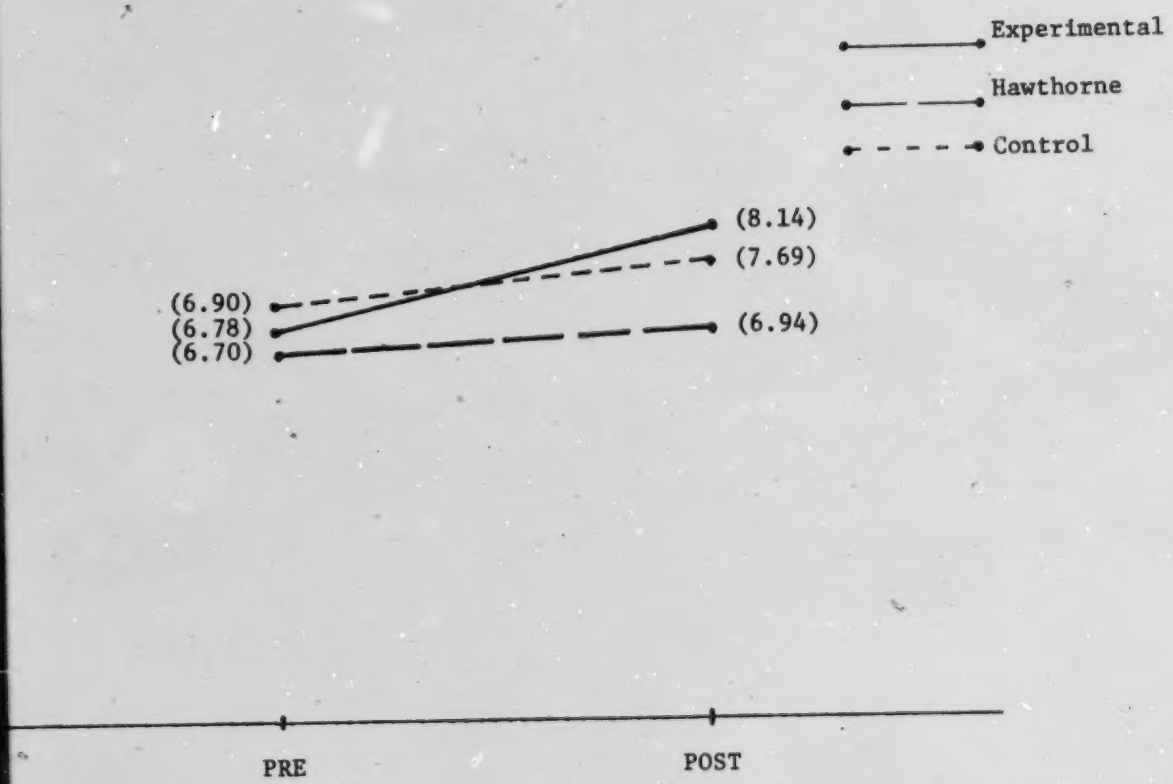
Two-way Repeated Measures ANOVA

| Source of Variance | df | MS | F | |
|---|---|---|---|---|
| Between Ss | 126 | — | — | |
| Treatment | 2 | 17.47 | <1 | ns |
| Error | 127 | 1203.40 | — | |
| Within Ss | 137 | — | — | |
| Tests (Pre, Post) | 1 | 51.17 | 28.59 | $p < .001$ |
| Treat. X Test | 2 | 13.26 | 3.70 | ns |
| Error | 124 | 222.10 | — | |

Figure 1. Mean achievement level of the treatment groups on the Weight Skills pret



Mean achievement level of the treatment groups on the Weight Skills pretest and posttest.



The data in Table 5 are presented graphically in Figure 1. Repeated measure *t* tests for each group indicated that the Experimental and Control groups showed a significant increase from pretest to posttest. The increase was clearly largest for the Experimental group. A two-way repeated measures analysis of variance revealed a signicant difference between pretests and posttests only. The expected interaction between tests and treatments was not observed (see Table 5).

Data related to pretest and posttest performance on the Weight Expressive Test are presented in Table 6 and Figure 2. Repeated measures *t* tests for each group indicated that only the Experimental and Control groups made significant changes from pretest to posttest. Again, the increase was clearly largest for the Experimental group. A two-way repeated measures analysis of variance on the Experimental group's data revealed significant differences between pretests and posttests, and a significant treatment by test interaction (see Table 6). Tests of simple effects on the interaction indicated that at the pretest, there was a significant difference between groups ($p < .001$), with the Controls performing better than the other two; at the posttest, there was also a significant difference ($ps < .001$), with Experimentals performing better than the other two groups, and Controls also performing better than the Hawthornes. The crucial tests, those between pretest and posttest performance for each group, confirmed the findings of the repeated measures *t* tests: Both the Experimental group [$F (1, 116) = 143.38$, $p < .001$] and the Control

Table 6

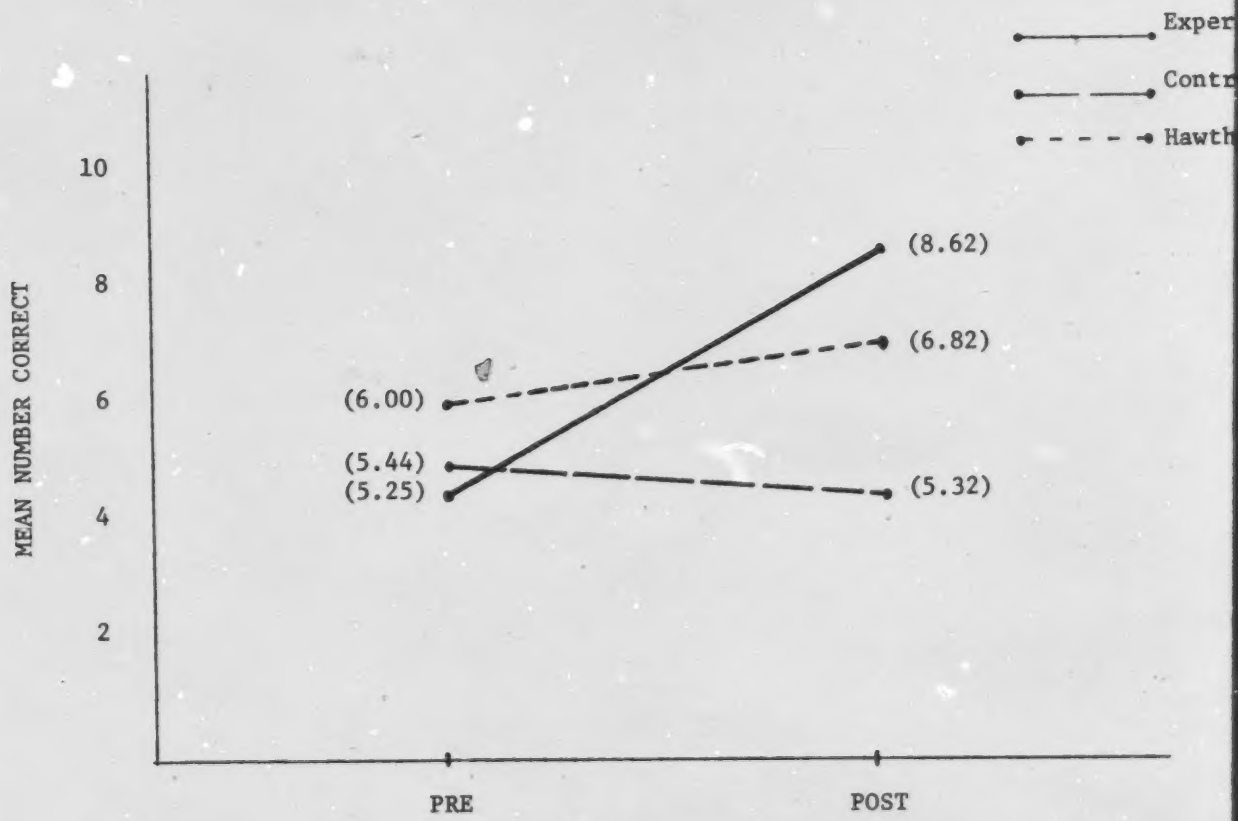
Pretest to Posttest Comparison of Subjects Receiving both Pre and Post Weight Expressive Tests

| | Experimental | | Hawthorne | | Control | |
|---|---|---|---|---|---|---|
| | Pre | Post | Pre | Post | Pre | Post |
| $\bar{X}$ | 5.25 | 8.62 | 5.44 | 5.32 | 6.00 | 6.82 |
| SD | 2.95 | 2.81 | 2.92 | 3.14 | 2.60 | 2.50 |
| n | 55 | 55 | 25 | 25 | 39 | 39 |
| | $t = 10.43$ | | $t < 1$ | | $t = 2.69$ | |
| | ($p < .001$) | | (ns) | | ($p < .01$) | |

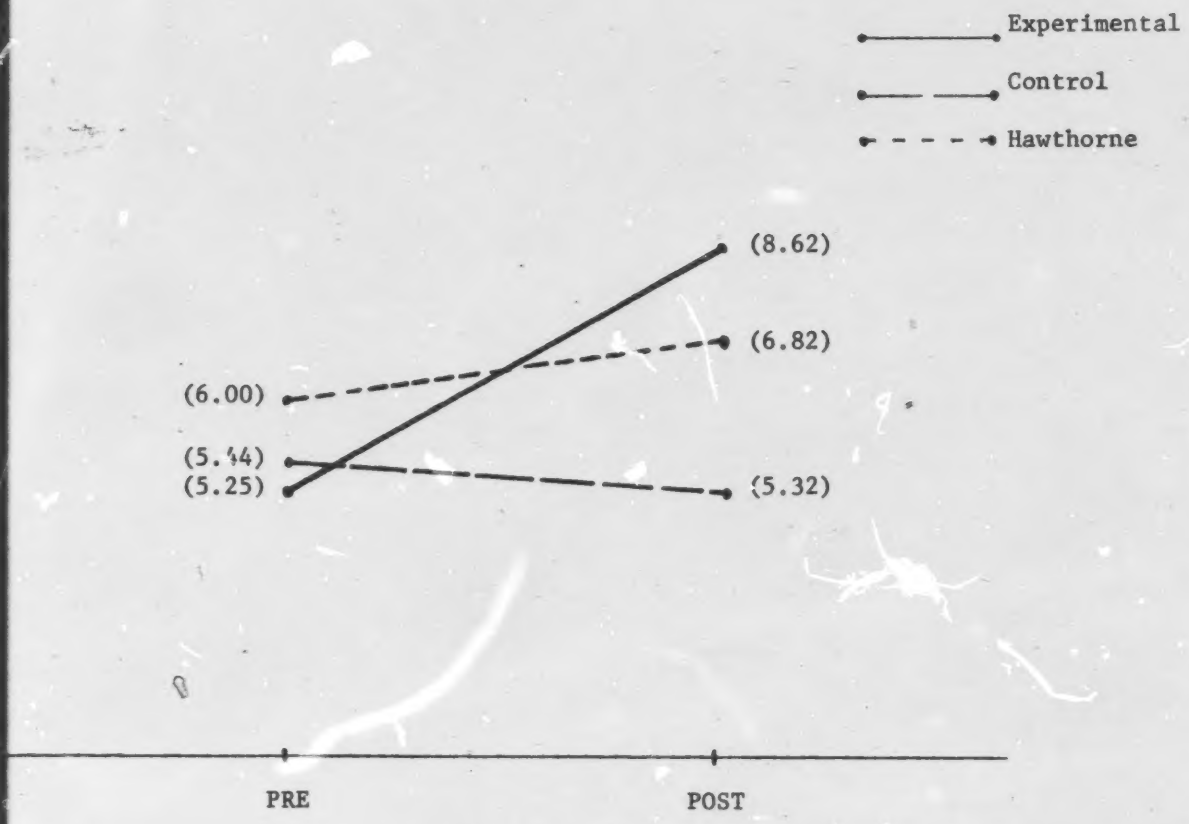
Two way Repeated Measures ANOVA

| Source of Variance | df | MS | F | |
|---|---|---|---|---|
| Between Ss | 118 | — | — | |
| Treatment | 2 | 41.68 | 3.05 | ns |
| Error | 116 | 13.65 | — | |
| Within Ss | 119 | — | — | |
| Tests (Pre, Post) | 1 | 192.42 | 88.67 | $p < .001$ |
| Treat. X Test | 2 | 66.02 | 30.42 | $p < .001$ |
| Error | 116 | 2.17 | — | |

Figure 2. Mean achievement level of the treatment groups on the Weight Expressive pre



ean achievement level of the treatment groups on the Weight Expressive pretest and posttest.



group [$F$ (1, 116) = 6.05, $p$ <.05] showed a significant improvement from pretest to posttest (other F < 1). Observation of Figure 2 further suggests that the improvement trend is most dramatic for the Experimental group on the Weight Expressive Test. From a position of the lowest status among the three groups, the Experimental group increased to the highest position.

Item Analyses

The Weight Skills and Expressive Tests were criterion referenced tests with items related directly to the behavioral objectives of the instruction. Table 7 presents the pretest and posttest per cent correct figures by test items for the Experimental treatment group on the combined Weight Tests (items have been integrated and grouped by where instruction related to them appears in the Unit).

Observation of Table 7 indicates that for almost every item, the Experimental subgroups showed a marked increase from pretest to posttest performance when they had received the relevant instruction. Another interesting phenomenon is revealed by the inspection of Table 7. Each subgroup seemed to improve on items even though instruction directly related to those items was not received. For example, one group of Experimental subjects ended instruction at Book 1, Lesson 2, the first grouping of items. Yet, on the second grouping of items, they continued to show achievement even though instruction had not been received. This phenomenon is also evident in the next two Experimental subgroups who did not complete all of the instruction. Such findings imply that the instruction results

Table 7

Percent Experimentals Responding Correctly on Individual Items

by Where Instruction was Stopped

| | Overall | | Book 1, L 2 | | Book 2, L 2 | | Book 2 L 4 | | Book 2 End | |
|---|---|---|---|---|---|---|---|---|---|---|
| Beginning to Book 1, Lesson 2 | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| Identifies heavy | 80 | 79 | 78 | 78 | 71 | 81 | 85 | 80 | 82 | 76 |
| Identifies light | 93 | 97 | 89 | 100 | 78 | 88 | 100 | 100 | 100 | 100 |
| Uses the comparative heavy | 57 | 97 | 33 | 89 | 50 | 100 | 65 | 100 | 65 | 94 |
| Identifies heavier | 92 | 95 | 89 | 100 | 78 | 81 | 100 | 100 | 94 | 88 |
| Uses comparative heaviest | 57 | 84 | 44 | 100 | 43 | 69 | 65 | 85 | 65 | 88 |
| | | | ENDED | | | | | | | |
| Book 1, Lesson 2 to Book 2, Lesson 2 | | | INSTRUCTION | | | | | | | |
| Uses comparative lighter | 47 | 63 | 0 | 33 | 43 | 62 | 40 | 65 | 82 | 76 |
| Labels a balance scale | 2 | 21 | 0 | 0 | 7 | 25 | 0 | 10 | 0 | 41 |
| Identifies lighter | 55 | 60 | 44 | 67 | 57 | 75 | 50 | 50 | 65 | 53 |
| Uses heavier than | 45 | 71 | 11 | 56 | 36 | 75 | 50 | 60 | 65 | 88 |
| Uses as heavy as | 33 | 71 | 11 | 22 | 21 | 81 | 45 | 80 | 41 | 76 |
| Demonstrates as heavy as | 35 | 61 | 11 | 44 | 57 | 69 | 30 | 65 | 35 | 59 |
| Identifies a scale | 42 | 82 | 22 | 56 | 21 | 75 | 50 | 95 | 59 | 88 |
| Defines a scale | 72 | 84 | 44 | 78 | 50 | 62 | 85 | 100 | 88 | 88 |
| Defines weighing | 35 | 47 | 11 | 56 | 21 | 56 | 45 | 20 | 47 | 65 |
| Matches scale to function | 47 | 50 | 33 | 44 | 36 | 44 | 50 | 40 | 59 | 82 |
| Uses pounds | 65 | 74 | 56 | 67 | 36 | 56 | 75 | 85 | 82 | 70 |
| Picks scale with weight 1 pound | 72 | 84 | 56 | 89 | 64 | 69 | 80 | 90 | 76 | 88 |
| | | | | | ENDED | | | | | |
| Book 2, Lesson 3 to Book 2, Lesson 4 | | | | | INSTRUCTION | | | | | |
| Relates a pound to a balance | 37 | 61 | 33 | 22 | 36 | 69 | 30 | 65 | 47 | 70 |
| Knows function of balance scale | 27 | 35 | 0 | 11 | 21 | 50 | 25 | 25 | 47 | 47 |
| Reads 1 lb. | 7 | 40 | 11 | 11 | 7 | 25 | 0 | 60 | 12 | 47 |
| Picks a scale showing weight of more than 20 pounds | 48 | 53 | 56 | 44 | 36 | 38 | 50 | 55 | 53 | 70 |
| Picks scale with a weight 7 ounces | 38 | 40 | 11 | 33 | 28 | 31 | 55 | 40 | 41 | 53 |
| Can read weight in ounces | 5 | 21 | 0 | 0 | 0 | 6 | 10 | 40 | 6 | 24 |
| Knows how many ounces in a pound | 0 | 13 | 0 | 0 | 7 | 0 | 5 | 15 | 6 | 29 |
| | | | | | | | ENDED | | | |
| Book 2, Lesson 4 to Book 2, End | | | | | | | INSTRUCTION | | | |
| Knows which is heavier: 1 pound or 5 ounces | 20 | 42 | 11 | 22 | 21 | 25 | 15 | 50 | 29 | 59 |
| Reads 20 oz. | 8 | 24 | 0 | 0 | 0 | 6 | 15 | 35 | 12 | 41 |
| Knows 3 tons is heavier than 3 pounds | 60 | 66 | 44 | 44 | 50 | 38 | 65 | 80 | 70 | 88 |
| | | | | | | | | | ENDED | |
| | | | | | | | | | INSTRUCTIO | |

in some generalized transfer, facilitation, or learning-to-learn effects. In other words, instruction on even part of the content of the Measurement of Weight Unit resulted in the acquisition of additional objectives.

Table 8 presents the same breakdown of test items as Table 7, but identifies the percentages of Experimental, Hawthorne, and Control subjects responding correctly to each item. In addition, for the Experimental group, it distinguishes between the percentages of those who received the instruction and those who did not. For all items in the first grouping, the lowest level of instruction which all Experimental subjects received, the percent correct for the Experimental subjects is about the same, or higher, than those for the other two groups. The efficacy of the Measurement of Weight Unit is more evident in the next group of items, where the Experimental subjects who did not receive the relevant instruction tended to respond at a level comparable to that of the Hawthorne subjects.

In general, Table 8 also reveals that the Control subjects tended to perform better than the Hawthorne subjects. Due to confounding from CA and IQ characteristics of the subjects (i.e., Hawthornes were significantly lower on these measures than one or both of the other two groups), it is difficult to determine whether or not any actual "Hawthorne" effects occurred in the present study. However, there was transfer in the Experimental group, where instruction in one part of the Measurement of Weight Unit resulted in better performance on objectives from material not yet presented. Such a

Table 8

Per Cent Responding Correctly in Each Treatment Group on Individual Items

| | Experimentals Overall | Experimentals Receiving Instruction | Experimentals Not Receiving Instruction | Hawthorne | Control |
|---|---|---|---|---|---|
| **Beginning to Book 1, Lesson 2** | | | | | |
| Identifies heavy | 79 | 79 | — | 82 | 82 |
| Identifies light | 97 | 97 | — | 95 | 95 |
| Uses the comparative heavy | 97 | 97 | — | 72 | 87 |
| Identifies heavier | 95 | 95 | — | 97 | 97 |
| Uses comparative heaviest | 84 | 84 | — | 56 | 69 |
| **Book 1, Lesson 2 to Book 2, Lesson 2** | | | | | |
| Uses comparative lighter | 63 | 68 | 33 | 31 | 64 |
| Labels a balance scale | 21 | 24 | 0 | 6 | 8 |
| Identifies lighter | 60 | 58 | 67 | 45 | 67 |
| Uses heavier than | 71 | 74 | 56 | 56 | 77 |
| Uses as heavy as | 71 | 79 | 22 | 39 | 64 |
| Demonstrates as heavy as | 61 | 64 | 44 | 53 | 54 |
| Identifies a scale | 82 | 87 | 56 | 50 | 67 |
| Defines a scale | 84 | 85 | 78 | 78 | 87 |
| Defines weighing | 47 | 45 | 56 | 28 | 51 |
| Matches scale to function | 50 | 51 | 44 | 45 | 49 |
| Uses pounds | 74 | 75 | 67 | 69 | 59 |
| Picks scale with weight 1 pound | 84 | 83 | 89 | 84 | 75 |
| **Book 2, Lesson 2 to Book 2, Lesson 4** | | | | | |
| Relates a pound to a balance | 61 | 97 | 52 | 25 | 36 |
| Knows function of balance scale | 35 | 57 | 4 | 29 | 38 |
| Reads 1 lb. | 40 | 65 | 4 | 3 | 10 |
| Picks a scale showing weight of more than 20 pounds | 53 | 78 | 16 | 45 | 72 |
| Picks scale with a weight 7 ounces | 40 | 59 | 12 | 21 | 31 |
| Can read weight in ounces | 21 | 35 | 0 | 3 | 3 |
| Knows how many ounces in a pound | 13 | 22 | 0 | 0 | 3 |
| **Book 2, Lesson 4 to Book 2, End** | | | | | |
| 1 Knows which is heavier: 1 pound or 5 ounces | 42 | 59 | 36 | 16 | 28 |
| Reads 20 oz. | 24 | 41 | 18 | 0 | 0 |
| Knows 3 tons is heavier than 3 pounds | 66 | 88 | 58 | 82 | 82 |

finding would indicate that there are potential transfer or learning-to-learn effects from the instruction in the Money, Measurement and Time Program.

Community Location Comparisons

During the formative evaluation stage, the Measurement of Weight Unit was written by teachers from an urban community and was pilot-tested with urban EMR children. To check the general effectiveness of the Weight Unit for different types of communities, comparisons of results by location were made.

Table 9 presents the Weight Skills posttest performance data for the three treatment groups when further defined in terms of community location. Results of the one-way analysis of variance carried out on each treatment group are also presented. Similar data for the Weight Expressive Test are presented in Table 10.

Generally, the rural children scored higher than their suburban and urban counterparts. This difference was significant for the Experimentals on both the Weight Skills Test and the Weight Expressive Test, and for Hawthornes and Controls on the Skills Test. It is likely that the community location differences are related to placement practices in special classes in these communities, and very likely is related to the higher IQ found for the rural group. The expressive component of the Measurement of Weight Unit appears to have been particularly efficacious for the rural children. If it can be assumed that the scores of the Control and Hawthorne groups are those that the Experimentals would have achieved without instruction (see Table 10), then the rural Experimentals doubled their expressive ability related to weight concepts.

Table 9

Comparisons of Weight Skills Posttest Data

for the Three Community Locations in each Treatment Group

| | Urban | Rural | Suburban | F |
|---|---|---|---|---|
| Experimental | | | | |
| $\bar{X}$ | 6.93 | 9.71 | 7.39 | 6.29 |
| SD | 2.07 | 2.49 | 2.99 | ($p < .01$) |
| n | 30 | 14 | 18 | |
| Hawthorne | | | | |
| $\bar{X}$ | 5.60 | 8.62 | 7.80 | 7.80 |
| SD | 2.11 | 2.40 | 2.05 | ($p < .01$) |
| n | 20 | 13 | 5 | |
| Control | | | | |
| $\bar{X}$ | 7.31 | 9.27 | 6.80 | 5.26 |
| SD | 1.65 | 2.00 | 2.21 | ($p < .01$) |
| n | 13 | 11 | 15 | |

Table 10

Comparison of Weight Expressive Posttest Data for the Three Community Locations in Each Treatment Group

| | Urban | Rural | Suburban | F |
|---|---|---|---|---|
| Experimental | | | | |
| $\bar{X}$ | 7.47 | 11.07 | 8.00 | 10.79 |
| SD | 2.27 | 2.30 | 2.81 | ($p < .01$) |
| n | 30 | 14 | 18 | |
| Hawthorne | | | | |
| $\bar{X}$ | 3.70 | 6.36 | 6.60 | 4.08 |
| SD | 2.78 | 3.27 | 1.14 | ($p < .05$) |
| n | 17 | 14 | 5 | |
| Control | | | | |
| $\bar{X}$ | 6.54 | 7.09 | 6.87 | <1 |
| SD | 2.66 | 2.59 | 2.44 | (ns) |
| n | 13 | 11 | 15 | |

Teacher Evaluation of the Measurement of Weight Unit

Four of the Experimental group teachers answered a questionnaire about the Measurement of Weight Unit. (See Appendix 2 for a copy of the questionnaire.) The number of years of teaching experience varied from 2 to 14 years, with a mean of 7.5 years (SD = 5.9). The number of years teaching EMR children ranged from 2 to 8, with a mean of 4.8 years (SD = 2.8). Three of the four reporting teachers were certified in special education.

On the evaluation forms, the teachers indicated that the Measurement of Weight Unit was taught each day of the week, and that about 20 minutes were spent preparing for each 30 minute teaching period. Various room arrangements were used to insure that the teacher, tape recorder, and picture book were close to the children during tape presentations.

All of the teachers indicated that they enjoyed the Unit "very much"; none indicated that they would rather use something else to teach weight. Half of the teachers felt the materials offered more diversity than most other materials, and none thought that teaching with the Weight Unit was boring. All of the teachers thought that most or all of the concepts covered in the Unit were important to children in the long run. All also thought that the children would remember the most important weight concepts a year after learning them, and that the children were more interested in this instruction than usual. Compared to other commercial materials they had used to teach weight, the teachers rated the Measurement of Weight Unit as more useable, effective and enjoyable.

Other teacher reactions to the instruction and a summary of the data are available in Appendix 3.

## Summary

The summative evaluation of the Measurement of Weight Unit described in the present paper served to document the effectiveness of the Unit for EMR children, and its useability in the classroom. Despite the fact that the completeness of the field-test was restricted by time limitations (instruction may have been presented faster than usual), it demonstrated that the Unit did, in fact, increase the EMR child's knowledge of weight skills and vocabulary. This increase was greater than that obtained by either a Control group or a Hawthorne control group (see Figures 1 and 2).

The effectiveness of the instruction in the Measurement of Weight Unit was supported by the pretest to posttest gains on the Weight Expressive test, and by the performance levels on individual items. The failure to find significant treatment effects on the Skills Test perhaps reflects the expressive focus of the Unit (i.e., to augment vocabulary skills related to weight).

Analyses of community location effects indicated that the Unit was quite effective in rural and suburban communities, as well as in the urban communities (the setting in which the materials were developed, pilot-tested, and revised). The finding that the rural Controls performed significantly better than their urban and suburban counterparts on the Expressive Test suggested that these Control teachers might be engaging in special procedures or using special materials to teach weight concepts to their children. When the Control teachers were asked to describe the instruction they had used, if any, four of the seven responding indicated that they had

taught weight concepts. Three of the teachers gave an estimate of the total number of days spent on weight instruction. The one suburban teacher averaged 5 days, and the one urban teacher indicated weight was taught for 2 days. On rural teacher taught weight for 17 days during the year (the other rural teacher indicated that instruction was given individually so that children spent "as much time as they needed" receiving weight instruction).

The useability of the Measurement of Weight Unit was also documented as a result of the present summative evaluation. Some difficulty in getting teachers to return evaluation forms was encountered during this field-test (cf., Latham, 1973; McLaughlin, 1973); this was probably due in part to the fact that they were requested to fill them out within the last two weeks of the school year. All of the responding teachers (57%) who used the Weight Unit indicated that they liked it and would prefer using it to other instructional materials. Most of the teachers thought the materials offered more diversity than most other materials, and were more useable, effective and enjoyable than other commercial materials they had used before.

The Measurement of Weight Unit presents weight skills and vocabulary which have been identified as important to the normal development of any child, especially the young EMR child (cf., Kolstoe, 1970; Nuffield, 1969; Peterson, 1973). The pretest data from the present field-test and from the formative evaluation of the Measurement of Weight Unit (cf., Thurlow, Krus, Howe, Taylor, and Turnure, 1974) indicated that these concepts, while important for all children to learn, are relatively difficult for retarded children to master without instruction. The summative evaluation

of the Measurement of Weight Unit has demonstrated its effectiveness and useability in the classroom, and has verified the belief that the Unit fulfills a need in the education of the young EMR child.

References

Cronbach, L. J. Course improvement through evaluation. Teacher's College Record, 1963, 64, 672-683.

Kolstoe, O. P. Teaching educable mentally retarded children. New York: Holt, Rinehart, & Winston, 1970.

Krus, P. H., Thurlow, M. L., Turnure, J. E., Taylor, A. M., & Howe, R. The formative evaluation design of the Money, Measurement and Time Program. Occasional Paper, in preparation. Research, Development and Demonstration Center in Education of Handicapped Children, University of Minnesota, Minneapolis, 1974.

Krus, P. H., Thurlow, M. L., Turnure, J. E., Taylor, A. M. Summative evaluation of the Measurement of Length Unit of the Money, Measurement and Time Program. Research Report, in preparation. Research, Development and Demonstration Center in Education of Handicapped Children, University of Minnesota, Minneapolis, 1974.

Latham, G. Measuring teacher responses to instructional materials. In J. R. Armstrong (Ed.), A sourcebook for the evaluation of instructional materials and media. Madison, Wisc.: National Evaluation Committee, 1973.

McLaughlin, J. A. Teacher evaluation of instructional materials. In J. R. Armstrong (Ed.), A sourcebook for the evaluation of instructional materials and media. Madison, Wisc.: National Evaluation Committee, 1973.

Nuffield Mathematics Project. New York: John Wiley & Sons, 1969.

Peterson, D. L. Functional mathematics for the mentally retarded. Columbus, Ohio: Charles E. Merrill, 1973.

Scriven, M. The methodology of evaluation. In R.W. Tyler, R. M. Gagne, & M. Scriven (Eds.), Perspectives of curriculum evaluation. AERA Monograph Series on Curriculum Evaluation. Chicago: Rand McNally, 1967.

Taylor, A. M., Thurlow, M. L., & Turnure, J. E. Elaboration as an instructional technique in the vocabulary development of EMR children. Research Report #59. Research, Development and Demonstration Center in Education of Handicapped Children, University of Minnesota, Minneapolis, 1974.

Thorndike, R. L., Hagen, E., & Lorge, I. Cognitive abilities test. Boston: Houghton Mifflin, 1968.

Thurlow, M. L., Krus, P. H., Howe, R., Taylor, A. M., & Turnure, J. E. Measurement of Weight Unit: A formative evaluation. Research Report, in preparation. Research, Development and Demonstration Center in Education of Handicapped Children, University of Minnesota, Minneapolis, 1974.

Thurlow, M. L., Taylor, A. M., & Turnure, J. E. The Money, Measurement and Time Program: Teacher's introduction. Research, Development and Demonstration Center in Education of Handicapped Children, University of Minnesota, Minneapolis, 1973.

## Footnotes

[1]The summative evaluation of the Measurement of Weight Unit was an extensive endeavor which would not have succeeded without the help and cooperation of many individuals. Appreciation is extended to all school systems participating in the field-test, and especially to the teachers who allowed a great deal of testing and who responded willingly to all requests made of them. Special thanks are due to Joni Blumenfeld Troup who scheduled and completed all testing, and who formed the major link between the Project and the teachers in the field-test.

[2]Arthur M. Taylor is now Supervisor of Programs for the Mentally Retarded in the St. Paul School System. His address is: Special Education Department, MR Program, St. Paul Public Schools, 360 Colborne, St. Paul, Minnesota, 55103.

Appendix 1. Introduction to the Measurement of Weight Unit

MONEY, MEASUREMENT and TIME PROGRAM

An INTRODUCTION to the

# MEASUREMENT OF WEIGHT UNIT

by

Martha L. Thurlow and Arthur M. Taylor

DEVELOPMENTAL VERSION

This introduction to the Measurement of Weight Unit should be read before any instruction in the Unit is started. The introduction presents the structure of the Unit and describes the general flow of instruction and its rationale. Careful reading of this introduction will allow you to better use the Teacher's Introduction to the Money, Measurement and Time Program and the Teacher's Editions for the Measurement of Weight Unit.

# VOCABULARY DEVELOPMENT PROJECT

Project Directors:

Arthur M. Taylor, James E. Turnure,
Martha L. Thurlow, Patricia H. Krus

Research, Development and Demonstration
Center in Education of Handicapped Children
University of Minnesota
Minneapolis, Minnesota

March, 1974

The materials presented herein were developed pursuant to a grant from the Bureau of Education for the Handicapped, U.S. Office of Education, Department of Health, Education, and Welfare to the Center for Research and Development in Education of Handicapped Children, Department of Special Education, University of Minnesota. Contractors undertaking such projects under government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official position of the Bureau of Education for the Handicapped.

Department of Health, Education, and Welfare
U. S. Office of Education
Bureau of Education for the Handicapped

Table of Contents


| | Page |
|---|---|
| Levels of Instruction | 1 |
| Placement in the Unit | 4 |
| Books of Instruction | 5 |
| Preparing to Teach the Unit | 6 |

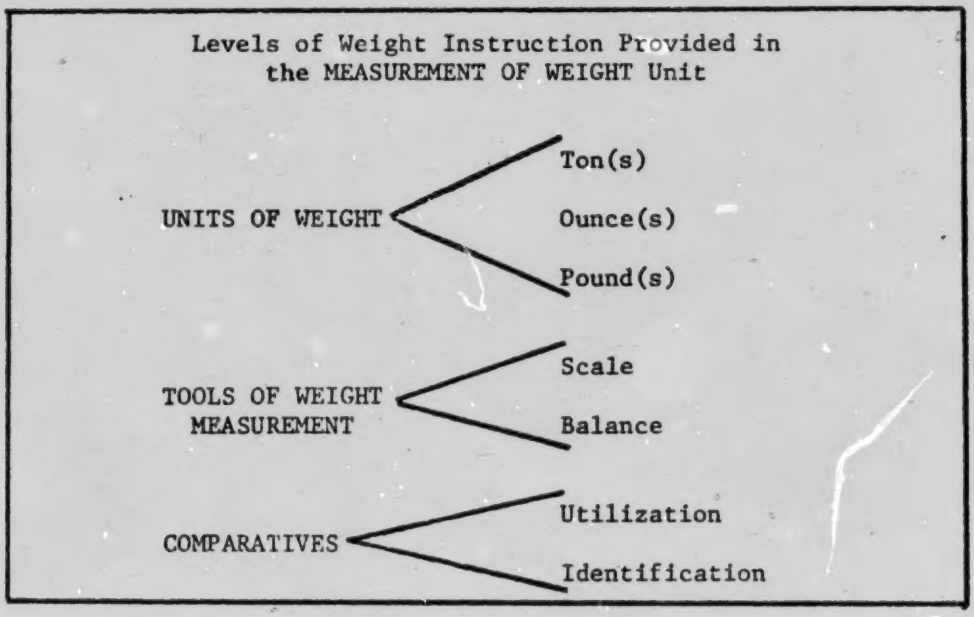
The Measurement of Weight Unit is part of the Money, Measurement and Time Program. It is designed for educationally handicapped children, and therefore, makes minimal entry requirements on the children. Reading is not required in this program, nor are mathematical skills required to enter the Unit. As noted in the Overview to the Unit (found on page ii of each of the Teacher's Editions), the children are required only to have a familiarity with the size concepts "big" and "little" and the terms "easy" and "hard".

The instruction in the Measurement of Weight Unit, like that in the other units of the Money, Measurement and Time Program, proceeds in small structured steps from vocabulary to skill development. The instruction stresses the "growth of meaning" of each of the vocabulary terms introduced, and gradually introduces skill development. In this way, the instruction represents a continuum from simple recognition, through vocabulary comprehension, and on to skill development.

Levels of Instruction

There are three basic levels of instruction in the Measurement of Weight Unit. These levels are presented on the following page, with the lowest level at the bottom of the chart and the highest level at the top. The chart shows the progression of the Unit from the identification and utilization of the comparatives of weight (e.g., "heavier", "lighter", etc.) to instruction related to the tools of weight measurement (the balance and the scale). The final level of instruction deals with the standard units of weight, the

pound, the ounce, and the ton. Instruction in this final level stresses the pound unit and develops appropriate weighing skills related to it.




Instruction related to weight measurement, and even to the vocabulary associated with weight concepts, is frequently ignored in the education of the young handicapped child. Yet, it is important that the handicapped learner have an understanding of these areas. He is frequently exposed to the terms of comparative weights, and of course, to references to exact weights (e.g., "How much do you weigh?" etc.). Even if the only weight skill the handicapped learner develops is the ability to weigh himself on a bathroom scale, the instruction related to weight found in the Measurement of Weight Unit will provide the child with a valuable awareness and understanding of the basic vocabulary related to

weight. Even the authors of most published math series have assumed a great deal about the child's understanding of weight concepts. Most often, it is assumed that the child understands the weight comparatives, and even that he has a general conception of what a "pound" or "ounce" is. These assumptions are probably inappropriate for most educationally handicapped children. For example, a child should not be asked to add and subtract pounds if he has no conception of what a pound is. Furthermore, he should not be asked to make comparisons between weights if he does not understand the basic weight comparatives.

The Measurement of Weight Unit is basically a preparatory unit. Most skills related to the actual measurement of weight are quite advanced skills, even in the learning of non-handicapped children. The understanding of the weight comparatives and the tools and units of weighing are not, however. Instruction related to these areas will provide a basic knowledge of the area for all learners, and will provide the necessary background for those older children who may need or want to develop more advanced weighing skills.

The lowest level of instruction in the Measurement of Weight Unit is intended to provide language-oriented instruction aimed at developing the basic comparatives of weight. Not all children will need instruction at this level, but if some of your children have difficulty understanding these concepts or using the terms appropriately, they should be given this instruction. Although the Measurement of Weight Unit requires no math skills at this lowest level, instruction on the recognition of numbers should be started since

this skill will be an asset in the last level of instruction where the children begin to use a scale in weighing.

The second level of instruction introduces the tools of weighing. The instruction on the balance scale provides an excellent review of the comparatives of weight. Furthermore, experience with the balance provides the children with a "standardized" method for making comparisons and develops their comparative abilities. Instruction related to a "regular" scale prepares the children for the standard units of weight. The children must understand this tool of weighing and its purpose before instruction on the units of weight and weighing skills is presented.

The last level of instruction is that most commonly associated with the area of "weight". It deals with the common units of weight, and with related instruction on "weighing" using a scale. The major focus of this final level of instruction is on the pound unit, and on the skill of weighing in pounds using a bathroom scale. The "ounce" and "ton" units are related to the pound so that the child has a general understanding of the relative weights of these units. Prerequisite instruction for the skills of weighing in pounds or ounces using scales other than the bathroom scale are provided so that follow-up instruction on these skills may be presented.

Placement in the Unit

Three points of entry into the instruction in the Measurement of Weight Unit have been specified, and are listed below. The entry points correspond, in general, to the three levels of instruction.

5

Entry Points into Measurement of Weight Instruction

| Instruction: | Placement Book | Lesson |
|---|---|---|
| 1. Comparatives of Weight | One | 1 |
| 2. The Balance | One | 5 |
| 3. Units of Weight | Two | 1 |

Children starting the instruction at the first entry point are generally young, and have had only minimal experience with the area of "weight". Children starting at the second entry point (Book One, Lesson 5) have a basic understanding of the weight comparatives, but generally have had no experience with the balance. Children who enter at the third point have mastered the comparatives of weight and their relation to the functioning of a balance, and are ready to learn about the units of weight and the skill of weighing using a scale.

Books of Instruction

The Measurement of Weight Unit has been structured into two books of instruction. The vocabulary words which form the basis of the instruction are presented below.

Vocabulary Words in Measurement of Weight Unit

| Book One: | Book Two: |
|---|---|
| heavy, light | scale, weigh, (weight) |
| heavier, heaviest | pound(s), (weight) |
| lighter, lightest | ounce(s) |
| "as heavy as" (same) | ton(s) |
| balance, (balancing, balanced) | |

Book One corresponds to the first level of instruction (Comparatives), and part of the second level (Tools of Weight Measurement). It presents the comparatives of weight, stressing the processes of identification and utilization, and then concludes with a lesson on the balance, which serves to review and reinforce all the concepts presented in the book. Book Two corresponds to the second (Tools of Weight Measurement) and third (Units of Weight) levels of instruction. It deals with the scale, the basic tool for measuring weight, and with several units of weight (pound, ounce, ton). Beginning weighing skills are introduced in relation to the "pound" unit for all children, with supplementary instruction on weighing in "ounces" also provided. More complete descriptions of the books in the Measurement of Weight Unit may be found in each Teacher's Edition on pages ii and iii (also see the related section in each Teacher's Edition entitled "Getting Started in Book....").

Preparing to Teach the Unit

The Teacher's Editions contain all the instruction encompassed in the Measurement of Weight Unit, and each one should be your "right hand" as you teach the Unit. In order to use the Teacher's Editions most effectively, you should be familiar with the structure of the Editions, and with the format and instructional techniques underlying the lessons in the Unit. Complete descriptions of these aspects of the instruction may be found in the Teacher's Introduction to the Money, Measurement and Time Program. It is suggested that after reading this introduction to the Measurement of Weight Unit, the next

step in preparing to teach the Unit should be to read the Teacher's Introduction to the Money, Measurement and Time Program.

All materials needed to teach the Measurement of Weight Unit will be supplied, except for the scale required for weighing in pounds (i.e., the bathroom scale), and a tape player. A specially designed balance scale will also be included in the materials accompanying the Unit. This balance has been developed to be somewhat less sensitive than commercially developed balances, and is one which the children should be able to manipulate relatively easily. Assembly instructions and guidelines for using the balance are also included. For the instruction related to weighing in pounds, it is recommended that you bring a bathroom scale to the classroom. Ideally, this scale should be one which has lines between the numbers, especially between the 0 and 10. If other types of scales are available to you, you should also present these to your class at the appropriate places noted in the instruction. Several objects for making weight comparisons will also be required, but the objects are ones which can easily be found within the classroom. The basic materials supplied with the Unit are student texts, audio tape cassettes, worksheets, transparencies, and materials for the Introductory Lesson. There are two types of student texts, which are to be used during the tape presentations: a Big Picture Book is used for Book One, and individual Children's Picture Books are used for Book Two. The basic types of materials used in the Money, Measurement and Time Program are described in the Teacher's Introduction.

Before beginning instruction in the Measurement of Weight Unit, it is extremely important that you be familiar with the suggested

procedures for using the materials in the Money, Measurement and Time Program, as well as with the content of the Measurement of Weight Unit itself. It is again strongly suggested that you read the Teacher's Introduction to the Money, Measurement and Time Program, especially the last section which deals with the use of the materials in the classroom. Second, it is suggested that you familiarize yourself with the purpose of each book and then with the structure of the instruction (by paging through several lessons). When you feel confident about your understanding of the Unit, you should begin the instruction. In every case, this will mean presenting the Introductory Lesson, which familiarizes the children with Benjie (the character who will introduce all tape presentations) and with the format of the tape presentations and the responses required of the children. Then, as you proceed to teach each lesson, you should prepare for each lesson by reading through the complete lesson before beginning any step of the instruction.

We feel that the Measurement of Weight Unit will be a rewarding learning experience for the children and an enjoyable teaching experience for you. Your understanding of the Unit, and your preparation for the instruction will certainly increase the effectiveness of the Unit.

Appendix 2. Teacher Evaluation Form

MEASUREMENT OF WEIGHT

Unit Evaluation

1. Where did you start teaching in the Weight Unit? Book_____ Lesson_____

2. Where did you stop teaching in the Weight Unit? Book_____ Lesson_____

3. Please indicate:
   a. The average preparation time for each teaching period: _____ minutes
   b. The average length of each teaching period: _____ minutes
   c. The average number of teaching periods per five day week: _____

4. Please indicate the percentage of time in which instruction was given to:

   Whole class_____%
   Small groups_____%
   Individuals_____%

---

1. How did you feel about using the Weight Unit?
   _____ I enjoyed it very much
   _____ I thought it was alright
   _____ I would rather use something else next time

2. Have you used any other commercial materials or math texts to teach weight concepts? _____ YES _____ NO
   If YES, what did you use?

   a. If given a choice of materials to use to teach weight:
      _____ I would prefer to use this Weight Unit rather than others
      _____ I would use either this Weight Unit or other weight materials; wouldn't matter
      _____ I would prefer to supplement this Weight Unit with other materials
      _____ I would prefer to use other materials all together

   b. Compared to other commercial materials, was the Weight Unit
      More useable? _____ YES _____ NO
      More effective? _____ YES _____ NO
      More enjoyable? _____ YES _____ NO

3. Did you get tired of teaching with these materials?
   _____ Yes, the repetiveness was boring
   _____ Sometimes, but the repetiveness is necessary to teach my students
   _____ No, these materials offer more diversity than most

4. How important do you think the concepts covered in the Weight Unit are to the children in the long run?

_____ All concepts are essential
_____ Most concepts are necessary
_____ Concepts are good, but not necessary
_____ Most concepts are not needed

5. Do you think the children will remember the more important weight concepts a year from now? _____ YES _____ NO

6. How effective were the materials:

_____ Very effective
_____ Effective
_____ Could have been more effective
_____ Not very effective at all

7. How interested were the children in the Weight instruction?

_____ More interested than usual
_____ About as interested as in other instruction
_____ Not very interested

---

Please rate the following aspects of the Weight Unit in terms of their appropriateness (or, completeness), <u>for you as the teacher</u>. Rate each item from 1 to 5, with 1 being the least appropriate (or, complete) and 5 being the most appropriate (or, complete).

| | Appropriateness | Completeness |
|---|---|---|
| a. Inservice training | | |
| b. Teacher's Editions, in general | | |
| c. Introductory pages to Teacher's Editions | | |
| d. Directions to teacher in lessons | | |
| e. Pre-activities | | |
| f. Lesson Organizers | | |
| g. Scripts accompanying tape presentations | | |
| h. Post-activities | | |
| i. Worksheets | | |
| j. Transparencies | | |

Please rate the following aspects of the Weight Unit in terms of their effectiveness, enjoyability, interest, and attention-focusing ability, for the children in your classroom. Rate each item from 1 to 5, with 1 being the least effective (enjoyable, interesting, or attention-focusing) and 5 being the most effective (enjoyable, interesting, or attention-focusing).

| | Effectiveness | Enjoyability | Interest | Attention-focusing |
|---|---|---|---|---|
| a. Introductory lesson (for preparation) | | | | |
| b. Benjie | | | | |
| c. Pre-activities | | | | |
| d. Tape recordings | | | | |
| e. Worksheets | | | | |
| f. Transparencies | | | | |
| g. Art work in books, worksheets, etc. | | | | |
| h. Post-activities for review | | | | |
| i. Post-activities to expand concepts | | | | |
| j. Post-activities to build skills | | | | |

1. Did you have any problems with the pre-testing and/or post-testing of the unit? _____ YES _____ NO
   If YES, what were the problems?

2. Where did the pre-test results suggest that you start teaching the Weight Unit? Book_____ Lesson_____

3. Did you agree with the recommended starting point? _____ YES _____ NO

4. Did you teach all the lessons between the points at which you started and stopped instruction? _____ YES _____ NO
   If NO, what did you skip?

5. At what mental age would you recommend that children could start in the Weight Unit? _____

6. Are there any children for whom you feel the Weight Unit is not appropriate?

7. How long do you think it would take your children to complete the entire Weight Unit?

8. How long do you think it would take your children to cover the same content as presented in the Weight Unit, without the use of the program?

9. Which of the following teacher-administered assessment devices would you like to see added to the Teacher's Editions to evaluate the children's progress?

_____ Lesson tests
_____ Book tests
_____ Unit tests
_____ None

---

1. Look at the sequence of the entire Weight Unit. Is there any way you would change the sequence? _____ YES _____ NO
If YES, how?

2. How do you feel about the completeness of the Weight Unit?

_____ Needs more instruction at the beginning
_____ Needs more instruction at the end
_____ Unit is complete as it is

---

Frequently, when a new program of instruction is introduced into a classroom, other individuals see and react to the materials. Please rate the reactions of any of the following individuals to the Weight materials, on a scale of 1 to 5 (1 = negative reaction; 5 = positive reaction).

_____ Principal
_____ Parents
_____ Regular classroom teachers
_____ Aides
_____ Others

---

Please indicate:

a. Number of years of teaching experience (include all teaching except student teaching) _____
b. Number of years teaching educationally handicapped children _____
c. Are you certified in special education? ____ YES ____ NO

---

If you have the time and the inclination, are there any suggestions about the testing or the materials you would like to share with us?

Is there anything else you would like to tell us?

And, a FEW more general questions . . . . .

These questions have "popped up"as a result of some comments we have received. Please let us know how you feel.

Do you think the Money, Measurement and Time Program should be modified into a program of individualized instruction?

1. Did you like using the Big Picture Book? _____ Please note any suggestions you have for making the Big Picture Book more useable and/or more effective.

2. Did you like the children to have their own texts? _____ Please note any suggestions you have for making the Children's Picture Books more useable and/or more effective.

3. How do you think the student texts should be supplied to the classroom?
   - _____ Only in the form of Big Picture Books
   - _____ Only in the form of individual Children's Picture Books.
   - _____ In both forms, with both being used during the same tape presentation
   - _____ In both forms, with the teacher selecting the form to be used during a given tape presentation
   - _____ In one form for certain books and the other form for other books (i.e., as it is now)

4. What do you think would be the most effective and useful way to inform the teacher of the content of the tape presentations?
   - _____ Complete script (i.e., as is)
   - _____ Summary of script
   - _____ No script at all

Please describe the room arrangement you used during the tape presentations (e.g., children on floor around tape player, children at desks with tape player in front of room, etc.). Draw a diagram if this will clarify your response.

Is there any other room arrangement you think would be best for optimizing the effectiveness of the tape presentations?

---

What do you feel would be the best way to introduce a unit in the Money, Measurement and Time Program to a teacher planning to use it in the classroom?

_____ Inservice training session
_____ Written document describing unit flow, books, etc.
_____ Both inservice training and written document

The Teacher's Introduction to the Money, Measurement and Time Program was designed to familiarize the teacher with the total program. Please briefly describe your reactions to the Teacher's Introduction and any recommendations you have for improving it.

Appendix 3. Teacher Evaluations of the Measurement of Weight Unit

A. Teacher Characteristics

1. Number of years of teaching experience (all teaching except student teaching):

   $\bar{X}$ = 7.50 years
   SD = 5.92
   Range: 2-14

2. Number of years teaching educationally handicapped children:

   $\bar{X}$ = 4.75 years
   SD = 2.75
   Range: 2-8

3. Three teachers were certified in special education, one was not.

B. Teaching Characteristics

1. Average preparation time for each teaching period:

   $\bar{X}$ = 19.50 minutes
   SD = 7.14
   Range: 15-30 minutes

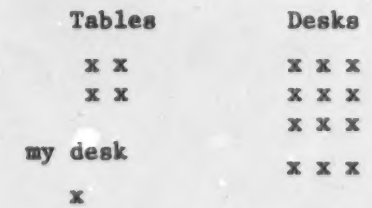
2. Average length of each teaching period:

   $\bar{X}$ = 28.75 minutes
   SD = 14.36
   Range: 20-50 minutes

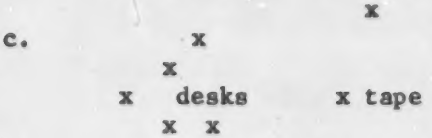
3. Average number of teaching periods per five day week:

   $\bar{X}$ = 5.0
   SD = 0
   Range: all taught for 5 days

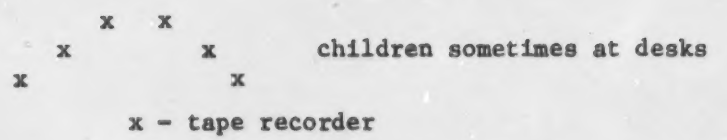
4. Room arrangements
   a. Children at desks in semi-circle with tape player in front.
   b. Children were usually at their desks and sometimes at tables with tape recorder close by.




c.



d.




NOTE: One teacher said for optimizing the effectiveness of the tape presentations, there should be close proximity to teaching materials and scales.

C. General Reactions to the Weight Unit

1. Item: "How did you feel about using the Weight Unit?"

| | |
|---|---|
| 100% | "I enjoyed it very much" |
| 0% | "I thought it was all right" |
| 0% | "I would rather use something else next time" |

2. Item: "Did you get tired of teaching with these materials?"

| | |
|---|---|
| 0% | "Yes, the repetiveness was boring" |
| 50% | "Sometimes, but the repetiveness is necessary to teach my students" |
| 50% | "No, these materials offer more diversity than most" |

3. Item: "How important do you think the concepts covered in the Weight Unit are to the children in the long run?"

| | |
|---|---|
| 50% | "All concepts are essential" |
| 50% | "Most concepts are necessary" |
| 0% | "Concepts are good, but not necessary" |
| 0% | "Most concepts are not needed" |

4. Item: "Do you think the children will remember the more important weight concepts a year from now?"

50% Yes 50% No

NOTE: One teacher said she didn't have enough time to really get the concepts down pat.

5. Item: "How effective were the materials?"

| | |
|---|---|
| 0% | "Very effective" |
| 100% | "Effective" |
| 0% | "Could have been more effective" |
| 0% | "Not very effective at all" |

6. Item: "How interested were the children in the Money instruction?"

100% "More interested than usual"
0% "About as interested as in other instruction"
0% "Not very interested"

D. Answers to Specific Questions

1. When asked to name other materials the teachers had used to teach weight, the following were noted:

Texts with chapters pertaining to weight
Math texts

When asked if given a choice of materials to use to teach weight, the following reactions were given:

75% "I would prefer to use this Weight Unit rather than others"
0% "I would use this Weight Unit or other money materials; wouldn't matter"
25% "I would prefer to Supplement this Weight Unit with other materials"
0% "I would prefer to use other materials all together"

When asked to compare the Weight Unit to other commercial materials they had used, the Weight Unit was rated as:

| | | | | |
|---|---|---|---|---|
| More usable? | 100% | Yes | 0% | No |
| More effective? | 100% | Yes | 0% | No |
| More enjoyable? | 100% | Yes | 0% | No |

2. Item: "At what mental age would you recommend that children could start in the Weight Unit?"

$\bar{X}$ = 5.0
SD = 0.8
Range = 4-6

3. Item: "Look at the sequence of the entire Weight Unit. Is there any way you would change the sequence?"

0% Yes 100% No

4. Item: "How do you feel about the completeness of the Weight Unit?"

| | |
|---|---|
| 25% | "Needs more instruction at the beginning" |
| 25% | "Needs more instruction at the end" |
| 50% | "Unit is complete as it is" |

NOTE: One teacher indicated she would like to see more instruction for heavier things in lbs. rather than in tons.

5. When asked to rate the reactions of other individuals to the Weight materials, the following were given:
(Rating is on scale of 1 to 5 from most negative reaction to most positive)

| | |
|---|---|
| 3.5 | Principal (n=2) |
| 3.5 | Parents (n=2) |
| 4.0 | Regular classroom teachers (n=2) |
| 4.0 | Aides (n=3) |
| 5.0 | Others (n=2) |

6. Item: "Which of the following teacher-administered devices would you like to see added to the Teacher's Editions to evaluate the children's progress?"

| | |
|---|---|
| 50% | Lesson tests |
| 25% | Book tests |
| 50% | Unit tests |
| 25% | None |

NOTE: Two teachers responded more than once.

7. Item: "Are there any children for whom you feel the Weight Unit is not appropriate?"

Responses:

"Not at this time"
"No"
"It was too advanced for some of the kids from TMR"
"My first grade children had problems reading the scale, but I'm sure if we had longer to study it and do all the exercises, they would have done better"

8. Item: (a) "How long do you think it would take your children to complete the entire Weight Unit?" (b) "How long do you think it would take your children to cover the same content as presented in the Weight Unit, without the use of the program?"

| (a) | (b) |
|---|---|
| 1 month | one whole school year |
| 6 weeks continuously | much longer if material was not as concise as this |
| 2 months to do it well | probably less time, but not as effective |
| NR | don't know |

E. Teacher Reactions to specific aspects of Weight Unit (mean rating on scale of 1 to 5, from negative to positive; all teachers responded to each item).

| | Appropriateness | Completeness | Average |
|---|---|---|---|
| 1. In-service training | 4.0 | 3.8 | 3.9 |
| 2. Teacher's Editions, general | 4.8 | 5.0 | 4.9 |
| 3. Introductory pages | 4.5 | 4.5 | 4.5 |
| 4. Directions to teachers in lessons | 4.2 | 4.8 | 4.5 |
| 5. Pre-activities | 5.0 | 5.0 | 5 |
| 6. Lesson organizer | 4.5 | 4.5 | 4.5 |
| 7. Scripts for tapes | 4.5 | 4.5 | 4.5 |
| 8. Post-activities | 5.0 | 5.0 | 5.0 |
| 9. Worksheets | 4.5 | 4.8 | 4.6 |
| 10. Transparencies | 4.5 | 4.8 | 4.6 |

Children Reactions to specific aspects of Weight Unit (mean rating by teacher on scale of 1 to 3, from negative to positive; all teachers responded to each item).

| | Effectiveness | Enjoyability | Interest | Attention Focusing | Average |
|---|---|---|---|---|---|
| 1. Introductory Lesson | 4.5 | 4.5 | 4.8 | 4.5 | 4.6 |
| 2. Mr. Money | 4.2 | 4.8 | 4.5 | 4.8 | 4.6 |
| 3. Pre-Activities | 4.8 | 4.8 | 4.8 | 4.5 | 4.4 |
| 4. Tapes | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |
| 5. Worksheets | 4.2 | 4.5 | 4.5 | 4.5 | 4.2 |
| 6. Transparencies | 4.5 | 4.8 | 4.8 | 4.8 | 4.4 |

F. Children Reactions to specific aspects of Weight Unit (cont.)

| | Effectiveness | Enjoyability | Interest | Attention Focusing | Average |
|---|---|---|---|---|---|
| 7. Art Work | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 |
| 8. Post Acts: Review | 4.5 | 4.5 | 4.8 | 4.5 | 4.6 |
| 9. Post Acts: Expand | 4.5 | 4.5 | 4.8 | 4.5 | 4.6 |
| 10. Post Acts: Skills | 4.5 | 4.5 | 4.8 | 4.5 | 4.6 |

G. Specific Questions about Materials in general

1. Item: "Did you like using the Big Picture Book?" (one teacher did not respond "yes or no", just gave a comment)

   100% Yes  0% No

   Specific Comments:

   a. The book should be made of heavy tagboard and made so it can stand up by itself.
   b. It would be handier if it had a cardboard stand.
   c. Children's attention was focused constantly on the big picture book. Having it by chain or twine or rope from the ceiling through the initial rings, using it as a flip chart.

   "Did you like the children to have their own texts?"

   100% Yes  0% No

   Specific Comments:

   a. Put the worksheets in the textbooks.
   b. I used them as a review after learning and teaching. We followed right along with the tapes. We used the pictures and a scale or scales to develop what was in the picture or pictures.

2. Item: "How do you think the student texts should be supplied to the classroom?"

   0% "Only in the form of Big Picture Books"
   0% "Only in the form of individual Children's Picture Books"
   0% "In both forms, with both being used during the same tape presentation"
   25% "In both forms, with the teacher selecting the from to be used during a given tape presentation"
   75% "In one form for certain books and the other form for other books (i.e., as it is now)

3. Item: "What do you think would be most effective and useful way to inform the teacher of the content of the tape presentations?"

100% Complete script (as it is)
0% Summary of script
0% No script at all

NOTE: One teacher said sometimes it's nice to read the script yourself - kind of a change for the kids.

4. Item: "Do you think the Money, Measurement and Time Program should be modified into a program of individualized instruction?" (2 no responses)

"The way the program is developed individualized teaching can be done accordingly at the present time."
"I think it would be more useful - individualized."

5. Item: "What do you feel would be the best way to introduce a unit in the Money, Measurement and Time Program to a teacher planning to use it in the classroom?"

25% In-service training
50% Written document describing unit flow, books, etc.
25% Both in-service training and written document

H. Teacher Comments (ones not specifically elicited by questionnaire)

I feel the unit on measurement has been well thought out, sequenced, and proceeds progressively. With a good review, the material should be mastered.

TECHNICAL REPORTS

University of Minnesota Research, Development and Demonstration
Center in Education of Handicapped Children

(Place of publication shown in parentheses where applicable)

1. P. Krus, M. Thurlow, J. Turnure & A. Taylor. Summative evaluation of the Time with the Clock Unit of the Money, Measurement and Time Program. Research Report #73. October 1974.

2. P. Krus, M. Thurlow, J. Turnure & A. Taylor. Summative evaluation of the Measurement of Weight Unit of the Money, Measurement and Time Program. Research Report #72. October 1974.

3. P. Krus, M. Thurlow, J. Turnure & A. Taylor. Summative evaluation of the Measurement of Length Unit of the Money, Measurement and Time Program. Research Report #71. October 1974.

4. P. Krus, M. Thurlow, J. Turnure & A. Taylor. Summative evaluation of the Money Unit of the Money, Measurement, and Time Program. Research Report #70. October 1974.

5. P. Krus, M. Thurlow, J. Turnure, A. Taylor & R. Howe. The formative evaluation design of the Vocabulary Development Project. Occasional Paper #31. October 1974.

6. J. Rynders, J. Horrobin, L. Wangsness & J. Swanson. The severe nature of verbal learning deficits in preschool Down's Syndrome (mongoloid) children. Research Report #69. August 1974.

7. R. Riegel. Reliability of children's sorting strategies using alternate forms of the SORTS test. Research Report #68. August 1974.

8. S. Fisher, D. Moores, & M. J. Harlow. Post-secondary programs for the deaf: III. Internal view. Research Report #67.

9. W. Bart. A set-theoretic model for the behavioral classification of environments. Occasional Paper #29. July 1974.

10. D. Krus, W. Bart & P. Airasian. Ordering theory and methods. Occasional Paper #28. July 1974.

11. B. Fgeland & A. Thibodeau. Selective attention of impulsive and reflective children. Research Report #66. July 1974.

12. R. Hoffmeister, B. Best & D. Moores. The acquisition of sign language in deaf children of deaf parents: Progress Report. Research Report #65. June 1974.

13. P. Krus. Use of family history data to predict intellectual and educational functioning longitudinally from ages four to seven. Research Report #64. June 1974.

14. P. Krus. Analyzing for individual differences in evaluating compensatory education programs. Occasional Paper #27. June 1974.

15. J. Rondal. The role of speech in the regulation of behavior. Research Report #63. June 1974.

16. N. Buium, J. Rynders, & J. Turnure. A semantic-relational-concepts based theory of language acquisition as applied to Down's Syndrome children: Implication for a language enhancement program. Research Report #62. May 1974.

17. D. Moores, M. Harlow, & S. Fisher. Post-secondary programs for the deaf: II. External view. Research Report #61. March 1974.

18. D. Moores, M. Harlow, & S. Fisher. Post-secondary programs for the deaf: I. Introduction and overview. Research Report #60. March 1974.

19. D. Krus. Synopsis of basic theory and techniques of order analysis. Occasional Paper #26. April 1974.

20. S. Samuels, J. Spiroff & H. Singer. Effect of pictures and contextual conditions on learning to read. Occasional Paper #25. March 1974.

21. A. Taylor, M. Thurlow & J. Turnure. Elaboration as an instructional technique in the vocabulary development of EMR children. Research Report #59. March 1974.

22. N. Buium & J. Turnure. The universality of self-generated verbal mediators as a means of enhancing memory processes. Research Report #58. January 1974.

23. D. Moores, K. Weiss, & M. Goodwin. Evaluation of programs for hearing impaired children: Report of 1972-73. Research Report #57. December 1973.

24. J. Turnure & W. Charlesworth, D. Moores, J. Rynders, M. Horrobin, S. Samuels, & R. Wozniak. American Psychological Association Symposium Papers. Occasional Paper #24. December 1973.

25. N. Buium. Interrogative types of parental speech to language learning children: a linguistic universal? Research Report #56. December 1973.

26. D. Krus. An outline of the basic concepts of order analysis. Occasional Paper #23. February 1974.

27. D. Krus. Order analysis: A fortran program for generalizable multidimensional analysis of binary data matrices. Occasional Paper #22. November 1973.

28. W. Bart. The pseudo-problem of IQ. Occasional Paper #21. October 1973.

29. J. Turnure & M. Thurlow. Verbal elaboration and the enhancement of language abilities in the mentally retarded: The role of interrogative sentence-forms. Occasional Paper #20. October 1973.

30. P. Dahl, S. Samuels & T. Archwamety. A mastery based experimental program for teaching poor readers high speech word recognition skills. Research Report #55. September 1973.

31. R. Riegel, F. Danner & L. Donnelly. Developmental trends in the generation and utilization of associative relations for recall by EMR and non-retarded children: The SORTS test. Research Report #54. August 1973.

32. R. Hoffmeister & D. Moores. The acquisition of specific reference in the linguistic system of a deaf child of deaf parents. Research Report #53. August 1973.

33. W. Bart & M. Smith. An interpretive framework of cognitive structures. Occasional Paper #19. June 1973.

34. C. Clark & J. Greco. MELDS (Minnesota Early Language Development Sequence) glossary of rebuses and signs. Occasional Paper #18. June 1973.

35. J. Turnure. Interrelations of orienting response, response latency and stimulus choice in children's learning. Research Report #52. May 1973.

36. S. Samuels & P. Dahl. Automaticity, reading and mental retardation. Occasional Paper #17. May 1973.

37. S. Samuels & P. Dahl. Relationships amc IQ, learning ability, and reading achievement. Occasional Paper #16. May 1973.

38. N. Buium & J. Rynders. The early maternal linguistic environment of normal and Down's Syndrome (Mongoloid) language learning children. Research Report #51. May 1973.

39. T. Archwamety & S. Samuels. A mastery based experimental program for teaching mentally retarded children word recognition and reading comprehension skills through use of hypothesis/test procedures. Research Report #50. May 1973.

40. W. Bart. The process of cognitive structure complexification. Research Report #49. April 1973.

41. B. Best. Classificatory development in deaf children: Research on language and cognitive development. Occasional Paper #15. April 1973.

42. R. Riegel, A. Taylor, & F. Danner. The effects of training in the use of grouping strategy on the learning and memory capabilities of young EMR children. Research Report #48. April 1973.

43. J. Turnure & M. Thurlow. The latency of forward and backward association responses in an elaboration task. Research Report #47. March 1973.

44. R. Riegel & A. Taylor. Strategies in the classroom: A summer remedial program for young handicapped children. Occasional Paper #14. March 1973.

45. D. Moores. Early childhood special education for the hearing impaired. Occasional Paper #13. February 1973.

46. R. Riegel & A. Taylor. A comparison of conceptual strategies for grouping and remembering employed by educable mentally retarded and non-retarded children. Research Report #46. February 1973.

47. J. Rynders. Two basic considerations in utilizing mothers as tutors of their very young retarded or potentially retarded children. Occasional Paper #12. January 1973.

48. R. Bruininks, J. Rynders & J. Gross. Social acceptance of mildly retarded pupils in resource rooms and regular classes. Research Report #45. January 1973.

49. J. Turnure & M. Thurlow. The effects of interrogative elaborations on the learning of normal and EMR children. Research Report #44. January 1973. (Proceedings of the International Association for the Scientific Study of Mental Deficiency, in press).

50. J. Turnure & S. Samuels. Attention and reading achievement in first grade boys and girls. Research Report #43. November 1972. (Journal of Educational Psychology, 1974, 66, 29-32).

51. R. Riegel, A. Taylor, S. Clarren, & F. Danner. Training educationally handicapped children to use associative grouping strategies for the organization and recall of categorizable materials. Research Report #42. November 1972.

52. R. Riegel, F. Danner, & A. Taylor. Steps in sequence: Training educationally handicapped children to use strategies for learning. Development Report #2. November 1972.

53. A. Taylor, M. Thurlow, & J. Turnure. The teacher's introduction to: The Math Vocabulary Program. Development Report #1. March 1973.

54. J. Turnure & M. Thurlow. The effects of structural variations in elaboration on learning by normal and EMR children. Research Report #41. September 1972.

55. A. Taylor & N. Bender. Variations of strategy training and the recognition memory of EMR children. Research Report #40. September 1972. (American Educational Research Journal, in press.)

56. D. Moores, C. McIntyre, & K. Weiss. Evaluation of programs for hearing impaired children: Report of 1971-72. Research Report #39. September 1972.

57. R. Rubin. Follow-up of applicant for admission to graduate programs in special education. Occasional Paper #11. July 1972.

58. D. Moores. Communication -- Some unanswered questions and some unquestioned answers. Occasional Paper #10. July 1972.

59. A. Taylor & S. Whitely. Overt verbalization and the continued production of effective elaborations by EMR children. Research Report #38. June 1972. (American Journal of Mental Deficiency, in press.)

60. R. Riegel. Measuring educationally handicapped children's organizational strategies by sampling overt groupings. Research Report #37. May 1972.

61. E. Gallistel, M. Boyle, L. Curran, & M. Hawthorne. The relation of visual and auditory aptitudes to first grade low readers' achievement under sight-word and systematic phonic instruction. Research Report #36. May 1972.

62. E. Gallistel & P. Fischer. Decoding skills acquired by low readers taught in regular classrooms using clinical techniques. Research Report #35. May 1972.

63. J. Turnure & M. Thurlow. Verbal elaboration in children: Variations in procedures and design. Research Report #34. March 1972.

64. D. Krus & W. Bart. An ordering-theoretic method of multidimensional scaling of items. Research Report #33. March 1972.

65. J. Turnure & S. Larsen. Effects of various instruction and reinforcement conditions on the learning of a three-position oddity problem by nursery school children. Research Report #32. March 1972.

66. J. Turnure & S. Larsen. Outerdirectedness in mentally retarded children as a function of sex of experimenter and sex of subject. Research Report #31. March 1972.

67. J. Rynders & M. Horrobin. A mobile unit for delivering educational services to Down's Syndrome (Mongoloid) infants. Research Report #30. January 1972. (Presented at Council for Exceptional Children, Special National Conference, Memphis, December, 1971.)

68. F. Danner & A. Taylor. Pictures and relational imagery training in children's learning. Research Report #29. December 1971. (Journal of Experimental Child Psychology, in press.)

69. J. Turnure & M. Thurlow. Verbal elaboration phenomena in nursery school children. Research Report #28. December 1971. (Study II: Proceedings of 81st Annual Convention of the American Psychological Association, 1973, 83-84.)

70. D. Moores & C. McIntyre. Evaluation of programs for hearing impaired children: Progress report 1970-71. Research Report #27. December 1971.

71. S. Samuels. Success and failure in learning to read: A critique of the research. Occasional Paper #9. November 1971. (In M. Kling, The Literature of Research in Reading with Emphasis on Modes, Rutgers University, 1971.)

72. S. Samuels. Attention and visual memory in reading acquisitions. Research Report #26. November 1971.

73. J. Turnure & M. Thurlow. Verbal elaboration and the promotion of transfer of training in educable mentally retarded children. Research Report #25. November 1971. (Journal of Experimental Child Psychology, 1973, 15, 137-148.)

74. A. Taylor, M. Josberger, & S. Whitely. Elaboration training and verbalization as factors facilitating retarded children's recall. Research Report #24. October 1971. (Journal of Educational Psychology, in press.)

75. W. Bart & D. Krus. An ordering-theoretic method to determine hierarchies among items. Research Report #23. September 1971.

76. A. Taylor, M. Josberger, & J. Knowlton. Mental elaboration and learning in retarded children. Research Report #22. September 1971. (Mental Elaboration and Learning in EMR children. American Journal of Mental Deficiency, 1972, 77, 69-76.)

77. J. Turnure & S. Larsen. Outerdirectedness in educable mentally retarded boys and girls. Research Report #21. September 1971. (American Journal of Mental Deficiency, in press.)

78. R. Bruininks, T. Glaman, & C. Clark. Prevalency of learning disabilities: Findings, issues, and recommendations. Research Report #20. June 1971. (Presented at Council for Exceptional Children Convention, Miami Beach, April, 1971.)

79. M. Thurlow & J. Turnure. Mental elaboration and the extension of mediational research: List length of verbal phenomena in the mentally retarded. Research Report #19. June 1971. (Journal of Experimental Child Psychology, 1972, 14, 184-195.)

80. C. Siegel. Three approaches to speech retardation. Occasional Paper #8. May 1971.

81. D. Moores. An investigation of the psycholinguistic functioning of deaf adolescents. Research Report #18. May 1971. (Exceptional Children, 1970, 36, 645-652.)

82. D. Moores. Recent research on manual communication. Occasional Paper #7. April 1971. (Keynote Address, Division of Communication Disorders, Council for Exceptional Children Annual Convention, Miami Beach, April 1971.)

83. J. Turnure, S. Larsen, & M. Thurlow. Two studies on verbal elaboration in special populations. I. The effects of brain injury; II. Evidence of transfer of training. Research Report #17. April 1971. (Study I: American Journal of Mental Deficiency, 1973, 78, 70-76.)

84. R. Bruininks & J. Rynders. Alternatives to special class placement for educable mentally retarded children. Occasional Paper #6. March 1971. (Focus on Exceptional Children, 1971, 3, 1-12.)

85. D. Moores. Neo-oralism and the education of the deaf in the Soviet Union. Occasional Paper #5. February 1971. (Exceptional Children, 1972, 39, 377-384.)

86. D. Feldman, B. Marrinan, & S. Hartfeldt. Unusualness, appropriateness, transformation and condensation as criteria for creativity. Research Report #16. February 1971. (American Educational Research Association Annual Conference, New York, February 1971.)

87. P. Broen & G. Siegel. Variations in normal speech disfluencies. Research Report #15. January 1971. (Language & Speech, in press.)

88. D. Feldman. Map understanding as a possible crystallizer of cognitive structures. Occasional Paper #4. January 1971. (American Educational Research Journal, 1971, 3, 484-502.)